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NATIONAL DAM INSPECTION PROGRAM. MINKLER LAKE DAM (NDI I.D. PA---ETC(U)
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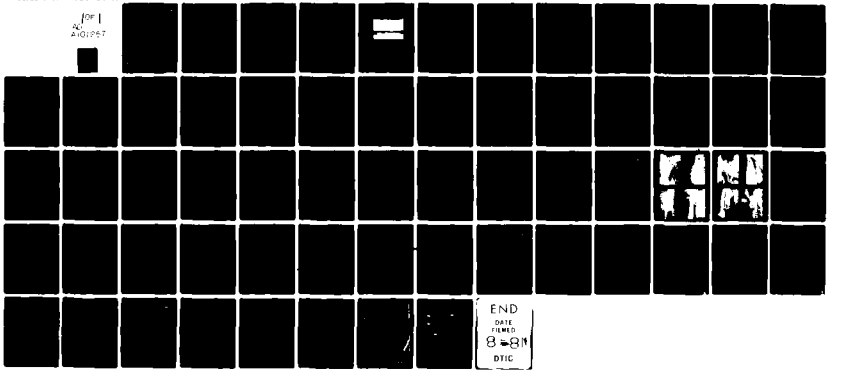

SUSQUEHANNA RIVER BASIN
APALACHIN CREEK, SUSQUEHANNA COUNTY

PENNSYLVANIA

MINKLER LAKE DAM

NDI I.D. PA-0052
DER I.D. 058-026
OWNERS: MR. ASA B. CHILSON
MR. MARIO ROMA

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

"Original contains color plates: All DTIC reproductions will be in black and white"

PREPARED FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND 21203

BY

D'APPOLONIA CONSULTING ENGINEERS
10 DUFF ROAD
PITTSBURGH, PA. 15235

Contract DACW31-81-C-0014

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigations and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

NAME OF DAM: Minkler Lake Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Susquehanna
STREAM: Apalachin Creek
SIZE CLASSIFICATION: Small
HAZARD CLASSIFICATION: Significant
OWNER: Mr. Mario Roma and Mr. Asa B. Chilson
DATE OF INSPECTION: March 24, 1981 and April 30, 1981

ASSESSMENT: Based on the evaluation of existing conditions, the condition of Minkler Lake Dam is considered to be poor. This dam appears to be essentially abandoned and is not being maintained. Upstream and downstream faces are covered with thick brush and trees. The upstream face of the dam lacks erosion protection and significant shoreline erosion exists at various sections along the upstream face. Operating equipment for the low level outlet pipe has collapsed and is not functional. Concrete in the spillway wing walls have deteriorated, requiring repairs.

The spillway capacity was evaluated according to recommended criteria and and found to be inadequate. According to the recommended criteria, small dams in the significant hazard category are required to pass from the 100-year flood to one-half the Probable Maximum Flood (PMF). In view of the potential downstream damage, one-half PMF was selected as the spillway design flood. The flood discharge capacity was evaluated according to the recommended procedure and was found to pass the 100-year flood and 30 percent of the PMF without overtopping the dam. Because the flood discharge capacity of the dam is less than the spillway design flood of 50 percent of the PMF, the spillway is classified to be inadequate.

The following recommendations should be implemented as soon as possible or on a continuing basis.

1. Trees and brush should be removed from the dam and erosion protection should be provided on the upstream face. The crest of the dam should be surveyed and low areas should be filled to design elevation.

2. The low level outlet facilities should be repaired and restored.

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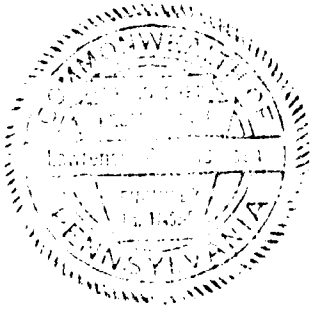
3. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert the downstream residents in the event of an emergency.

4. The owner should develop a formal operating and maintenance plan for the dam, inspect the dam regularly and perform necessary maintenance.



Lawrence D. Andersen, P.E.
Vice President

Date:

Approved by:

(11) 1981

James Zeck
James R. Zeck
Colonel, Corps of Engineers
Commander and District Engineer

17 Dec 1981
Date:

(6) National Dam Inspection Program. Minkler Lake Dam (NDI I.D. PA-0052 DER I.D. 058-026), Susquehanna River Basin, Apalachin Creek, Susquehanna County, Pennsylvania. Phase I Inspection Report,

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MINKLER LAKE DAM
NDI I.D. PA-0052
DER I.D. 058-026
MARCH 24, 1981

Overview

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
MINKLER LAKE DAM
NDI I.D. PA-0052
DER I.D. 058-026

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. Minkler Lake Dam consists of a concrete ogee-type gravity spillway structure flanked by earth embankments on each side. The dam is approximately 600 feet long with a maximum height of 11 feet from the downstream toe and a crest width of 6 to 8 feet. The upstream face generally has a 1 horizontal to 1 vertical slope, but is locally steeper at various sections due to shoreline erosion. The downstream slope is about 2 horizontal to 1 vertical. The upstream face, crest and downstream face are covered with brush and large trees. The flood discharge facilities for the dam consist of an overflow spillway located near the left abutment (looking downstream). The spillway is a 65-foot-wide ogee-type concrete overflow section. The spillway discharges into a plunge pool at the toe of the dam, which in turn discharges into the natural streambed. The outlet facilities consist of a 24-inch-diameter corrugated metal pipe extending through the embankment to the left of the spillway. The flow through the outlet pipe is controlled by a gate at the upstream end of the pipe. This outlet facility constitutes the emergency drawdown system for the reservoir.

b. Location. Minkler Lake Dam is located across Apalachin Creek, two miles upstream from the central part of Apalachin Township, Susquehanna County, Pennsylvania (N41° 57.7', W76° 06.1°). Plate 1 illustrates the location of the dam.

c. Size Classification. Small (based on 11-foot height and 568 acre-feet storage capacity).

d. Hazard Classification. The dam is classified to be in the significant hazard category. Downstream from the dam, Apalachin Creek

flows through a wide floodplain for about two miles, then flows under a highway bridge on State Route 858 in Little Meadows. All structures located on the floodplain along this reach are approximately 10 feet or more above the streambed. It is estimated that a failure of this dam might damage State Route 858 and cause property damage in Little Meadows. Loss of a few lives is considered possible in this area.

e. Ownership. Mr. Mario Roma, 325 Sky Island Drive, Endicott, New York 13760 and Mr. Asa B. Chilson, 3001 Wayne Street, Endwell, New York 13760.

f. Purpose of Dam. Recreation.

g. Design and Construction History. The dam was designed by Mr. C. P. Allen of Tunkhannock, Pennsylvania, and constructed by the owner, with completion in 1952. The remains of an old earth dam existing at the same location was incorporated into the 1952 construction.

h. Normal Operating Procedure. The reservoir is normally maintained at the spillway crest level (Elevation 1150, USGS Datum), leaving 4.3 feet of freeboard to a low area at the top of the dam at Elevation 1154.3. All inflow occurring when the reservoir level is at the spillway crest elevation or above is discharged over the uncontrolled spillway.

1.3 Pertinent Data. Elevations referred to in this and subsequent sections of the report were calculated based on field measurements, assuming the crest of the spillway to be at Elevation 1150 (USGS Datum), which is the elevation interpolated as the normal pool elevation from the USGS 7.5-minute Friendsville quadrangle.

a. Drainage Area	3.3 square miles
b. Discharge at Dam Site (cfs)	
Maximum known flood at dam site	Unknown
Outlet conduit at maximum pool	Unknown
Gated spillway capacity at maximum pool	Not applicable
Ungated spillway capacity at maximum pool	2318
Total spillway capacity at maximum pool	2318
c. Elevation (USGS Datum) (feet)	
Top of dam	1154.3 (low spot) 1156 (as designed)
Maximum pool	1154.3
Normal pool	1150.0
Upstream invert outlet works	Unknown
Downstream invert outlet works	1143
Maximum tailwater	Unknown
Toe of dam	1143

d. Reservoir Length (feet)

Normal pool level	3200
Maximum pool level	4100

e. Storage (acre-feet)

Normal pool level	243
Maximum pool level	568

f. Reservoir Surface (acres)

Normal pool level	56.0
Maximum pool level	73.8

g. Dam

Type	Earth embankment with concrete gravity spillway.
Length	600 feet
Height	11 feet
Top width	6 to 8 feet
Side slopes	Downstream: 2H:1V; Upstream: Not determinable
Zoning	No
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	No

h. Regulating Outlet

Type	24-inch-diameter corrugated metal pipe
Length	73± feet (measured from design drawings)
Closure	24-inch gate valve
Access	None
Regulating facilities	Gate valve

i. Spillway

Type	Ogee-type concrete structure
Length	65 feet (perpendicular to flow)
Crest elevation	1150.0 (low flow)
Upstream channel	Lake
Downstream channel	Earth channel

SECTION 2
DESIGN DATA

2.1 Design

a. Data Available. The available data consist of files provided by the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER), which contain design drawings, correspondence and inspection reports.

(1) Hydrology and Hydraulics. No original hydrology and hydraulic design data are available for the dam. A Commonwealth of Pennsylvania report entitled "Report Upon the Application of Mario Roma and Asa B. Chilson," dated February 14, 1951, contains the criteria used to size the spillway.

(2) Embankment. The available information consists of design drawings.

(3) Appurtenant Structures. The available information consists of design drawings.

b. Design Features

(1) Embankment. Plate 2 shows the location of the dam and the plan of the reservoir. As shown in Plate 3, the earth-fill sections of the dam were to be a homogeneous impervious fill. Material was to be placed in horizontal layers eight inches thick and well compacted. No internal drainage system was incorporated in the embankment design.

The embankment was designed to have a slope of 2 horizontal to 1 vertical both upstream and downstream.

(2) Appurtenant Structures. The appurtenant structures consist of the concrete ogee-type spillway and the outlet works. Details of the spillway are shown in Plates 3 and 4. The overflow section of the spillway is 65 feet wide. As shown in Plate 4, an earth fill was placed on the upstream side of the concrete spillway. The spillway foundation is shown to be founded on hardpan with a two-foot-wide wall three feet deep in the center of the foundation.

The outlet works consist of a 24-inch-diameter corrugated metal pipe encased in concrete. The upstream end of the pipe is equipped with a concrete intake structure. Flow through the pipe is controlled by a gate located at the upstream end of the pipe.

c. Design Data

(1) Hydrology and Hydraulics. A Commonwealth of Pennsylvania report entitled "Report Upon the Application of Mario Roma and Asa B. Chilson, dated February 15, 1951, indicates that the spillway was sized

to pass a discharge of 2820 cfs with the water level at the designed top of the dam.

(2) Embankment. No engineering data are available on the design of the embankment.

(3) Appurtenant Structures. No engineering data are available on the appurtenant structures.

2.2 Construction. Very little information is available concerning construction of the dam. Two state memorandums concerning inspection of the dam during construction, dated December 7, 1951 and May 5, 1952, by W. W. Gruber, cite evidence of poor embankment construction. The embankment width was designed to be 10 feet, but field measurements indicate a width varying from 6 to 8 feet.

Available records indicate no major postconstruction work was performed other than repairs which were made to correct cracks and deterioration of the concrete in the spillway.

2.3 Operation. There are no formal operating records maintained for the dam.

2.4 Other Investigations. The available information indicated no investigations other than the periodic inspections conducted by the state. The last state inspection was conducted in 1965.

2.5 Evaluation

a. Availability. The available information was provided by the Commonwealth of Pennsylvania, Department of Environmental Resources.

b. Adequacy

(1) Hydrology and Hydraulics. The available information is limited. Only the watershed area and design discharge capacity of the spillway are reported.

(2) Embankment. Other than design drawings, no information is available to assess the adequacy of the design of the dam.

(3) Appurtenant Structures. Review of the design drawings indicates that, as designed, no significant deficiencies exist that should affect the overall performance of the spillway.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The onsite inspection of Minkler Lake Dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.

2. Visual examination of the spillway and its components, the downstream end of the outlet pipe, and the outlet works control structure.

3. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 5.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

In general, the condition of the embankment is considered to be poor. The upstream area, crest and downstream face are covered with brush and large trees. The upstream face lacks erosion protection and significant shoreline erosion exists at various locations. At some sections the upstream slope is essentially vertical.

The top of the dam was surveyed relative to the spillway crest elevation and was found to have some vertical irregularities. While the design freeboard for the dam was six feet, the field survey indicated a freeboard of 4.3 feet between the low spot of the embankment and the spillway crest. Plate 6 shows the dam crest profile.

c. Appurtenant Structures. The appurtenant structures were examined for deterioration or other signs of distress and obstructions that would limit flow. In general, the structures were found to be in fair condition. While the concrete surfaces on the spillway wing walls have deteriorated, the concrete in the overflow is in fair condition. The outlet pipe gate hoist structure has collapsed and is not functional.

d. Reservoir Area. A map review indicates that the watershed is predominantly wood and swamplands. A review of the regional geology is included in Appendix G.

e. Downstream Channel. Below the dam, the stream flows through a wide valley for about two miles where it flows under a highway. Further description of the downstream conditions is included in Section 1.2 d.

3.2 Evaluation. In view of significant shoreline erosion along the upstream face and due to the presence of thick brush and large trees on the upstream area, crest and downstream face of the dam, the condition of the dam is considered to be poor, requiring repair and restoration. The outlet pipe gate operating equipment has collapsed, also requiring repair and restoration.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. There are no formal operating procedures for the dam. The reservoir is normally maintained at the spillway crest level with excess inflow discharging through the uncontrolled spillway.

4.2 Maintenance of the Dam. The maintenance condition of the dam is considered to be poor. It appears that no attempts have been made to clear the brush and trees from the embankment. It also appears that no attempts have been made to alleviate shoreline erosion problems along the upstream face of the embankment or to repair the concrete deterioration on the spillway wing walls.

4.3 Maintenance of Operating Facilities. The only operating facility for the dam is the 24-inch sluice gate valve on the outlet pipe. The operating equipment has collapsed and is not functional.

4.4 Warning System. No formal warning system exists for the dam. Telephone communication facilities are available via residences near the dam site.

4.5 Evaluation. The maintenance condition of the dam and the operating facilities are considered to be poor. It appears that no attempts have been made to maintain the dam or the operating equipment. Restoration of the concrete in the spillway structures, clearing of brush and trees from the dam, correction of upstream erosion problems and evaluation of the operational condition of the outlet facilities are required.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Minkler Lake Dam has a watershed area of 3.3 square miles and impounds a reservoir with a surface area of 56.0 acres at normal pool level. Flood discharge facilities for the dam consist of a concrete ogee-type spillway structure. Based on the available head relative to the low spot on the right embankment, the capacity of the spillway is estimated to be 2318 cfs with no freeboard.

b. Experience Data. As previously stated, Minkler Lake Dam is classified as a small dam in the significant hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass flows between the 100-year flood and one-half of the PMF. In view of the potential downstream damage, one-half PMF was selected as the spillway design flood.

The PMF inflow hydrograph for the reservoir was determined utilizing the Dam Safety Version of the HEC-1 computer program developed by the Hydrologic Engineering Center of the U.S. Army, Corps of Engineers. The data used for the computer analysis are presented in Appendix D. As determined by the computer program, the one-half PMF inflow hydrograph has a peak of 3523 cfs. The 100-year flood peak was determined according to the recommended procedure and was found to be 2030 cfs. Computer input and a summary of computer output and 100-year flood calculations are included in Appendix D.

c. Visual Observations. On the date of inspection, no conditions were observed that would indicate that the spillway capacity would be significantly reduced in the event of a flood.

d. Overtopping Potential. The available spillway capacity was found to be sufficient to pass the peak of a 100-year flood. Various percentages of the PMF inflow were routed through the reservoir and it was found that the dam can pass 30 percent of the PMF without overtopping the dam. For 50 percent of the PMF, it was found that the low area on the right embankment would be overtopped for a duration of 2.8 hours with a maximum depth of 0.7 foot.

e. Spillway Adequacy. Because the spillway cannot pass the recommended spillway design flood of one-half PMF without overtopping the dam, the spillway is classified to be inadequate.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, significant shoreline erosion exists along the upstream face of the dam and the embankment is covered with brush and large trees. These conditions may affect the integrity of the embankment if not adequately corrected.

(2) Appurtenant Structures. No signs of distress were noted that would affect the stability of the appurtenant structure at this time.

b. Design and Construction Data

(1) Embankment. The available design and construction information does not provide any quantitative data to aid in the assessment of stability. However, as previously noted, field observations did not reveal any signs of distress that would significantly affect the stability of the embankment at this time and none were reported in the past. Therefore, based on visual observations, the static stability of the embankment is considered to be adequate.

(2) Appurtenant Structures. Other than design drawings, no design and construction data exist for the appurtenant structures. Review of these drawings indicates that there are no apparent structural deficiencies that would significantly affect the performance of the appurtenant structures.

c. Operating Records. None available.

d. Postconstruction Changes. It is reported that repairs were made to the training walls of the spillway. These modifications are not considered to affect the structural stability of the dam.

e. Seismic Stability. The dam is located in Seismic Zone 1, and based on visual observations, the static stability of the dam is considered to be adequate. Therefore, based on the recommended criteria for the evaluation of seismic stability of dams, the structure is presumed to present no hazard as a result of earthquakes.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that Minkler Lake Dam is in poor condition. There is significant erosion along the upstream face due to wave action and lack of erosion protection and the dam is overgrown with brush and large trees. It is considered possible that the integrity of the dam may be significantly affected if these conditions are not corrected. The low level outlet facilities were found to be nonfunctional.

The spillway was evaluated according to the recommended procedure and was found to pass 30 percent of the PMF without overtopping the dam. This capacity is less than the spillway design flood of one-half PMF. Therefore, the flood discharge capacity is classified to be inadequate.

b. Adequacy of Information. The available information, in conjunction with visual observations, is considered to be sufficient to make a Phase I evaluation.

c. Urgency. The following recommendations should be implemented as soon as possible or on a continuing basis.

d. Necessity for Additional Investigations. None required.

7.2 Recommendations/Remedial Measures. It is recommended that:

1. Trees and brush should be removed from the dam and erosion protection should be provided on the upstream face. The crest of the dam should be surveyed and low areas be filled to design elevation.

2. The low level outlet facilities should be repaired and restored.

3. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert the downstream residents in the event of an emergency.

4. The owner should develop a formal operating and maintenance plan for the dam, inspect the dam regularly and perform necessary maintenance.

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Minkler Lake COUNTY Susquehanna STATE Pennsylvania ID# NDI: PA-0052 DER: 058-026

TYPE OF DAM Earth HAZARD CATEGORY Significant

DATE(S) INSPECTION March 24, 1981 WEATHER Cloudy TEMPERATURE 35

POOL ELEVATION AT TIME OF INSPECTION 1150 M.S.L. TAILWATER AT TIME OF INSPECTION 1143 M.S.L.

INSPECTION PERSONNEL:	REVIEW INSPECTION PERSONNEL: (April 30, 1981)
Arthur Smith	Lawrence D. Andersen
Wah-Tak Chan	James H. Poellot
Bilgin Erel	Bilgin Erel

Bilgin Erel RECORDER

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	See Plate 6 for dam crest profile. No significant horizontal misalignment observed.	
RIPRAP FAILURES	Upstream slope has no shoreline riprap protection.	Adequate shoreline erosion protection (e.g., riprap) should be provided along the upstream slope of the dam.

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problem observed.	
ANY NOTICEABLE SEEPAGE	None observed.	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed.	
INTAKE STRUCTURE	Outlet pipe intake was submerged and not visible during inspection.	
OUTLET STRUCTURE	No structural problems observed.	
OUTLET CHANNEL	Outlet channel was not defined and was partially blocked with debris.	
EMERGENCY GATE	According to the owner, flow through the outlet pipe is controlled by an upstream valve which is submerged and not operable.	Means for operating outlet pipe valve should be developed

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete spalling on spillway wing walls and crest.	
APPROACH CHANNEL	Lake. No obstructions.	
DISCHARGE CHANNEL	Earth channel with some riprap.	
BRIDGE AND PIERS	None	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	The dam has no gated spillway.	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

VISUAL INSPECTION
PHASE I
INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

VISUAL INSPECTION
PHASE I
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	No problem observed.	
SEDIMENTATION	Unknown	
UPSTREAM RESERVOIRS	One beaver dam located approximately two miles downstream.	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No problems observed.	
SLOPES	No problems observed.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Little Meadows (approximately 20 persons) located two miles downstream.	

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
AND HYDROLOGIC AND HYDRAULIC
PHASE I

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Minkler Lake

ID# NDI: PA-0052
DER: 058-026

ITEM	REMARKS
AS-BUILT DRAWINGS	The design drawings are available in state files.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	Originally built prior to 1919, restoration completed in 1952.
TYPICAL SECTIONS OF DAM	See Plates 3 and 4.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	See Plates 2 and 3.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None available.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No computations available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	None available.
MONITORING SYSTEMS	None
MODIFICATIONS	Restoration of old dam and spillway in 1952.
HIGH POOL RECORDS	None recorded.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported.
MAINTENANCE OPERATION RECORDS	No maintenance records kept for the dam.
SPILLWAY PLAN SECTIONS DETAILS	See Plates 3 and 4.
OPERATING EQUIPMENT PLANS AND DETAILS	See Plate 3.

CHECKLIST
ENGINEERING DATA
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 3.3 square miles (heavily wooded watershed)

ELEVATION, TOP OF NORMAL POOL AND STORAGE CAPACITY: 1150 (243 acre-feet)

ELEVATION, TOP OF FLOOD CONTROL POOL AND STORAGE CAPACITY: 1154.3 (568 acre-feet)

ELEVATION, MAXIMUM DESIGN POOL: 1156.0

ELEVATION, TOP OF DAM: 1154.3

SPILLWAY:

a. Elevation 1150±

b. Type Ogee concrete overflow section

c. Width 65 feet (perpendicular to flow)

d. Length 5 feet at base

e. Location Spillover Near left abutment

f. Number and Type of Gates None

OUTLET WORKS:

a. Type 24-inch corrugated metal pipe

b. Location Near left abutment

c. Entrance Inverts Unknown

d. Exit Inverts 1143.0±

e. Emergency Drawdown Facilities 24-inch corrugated metal pipe

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

c. Records None

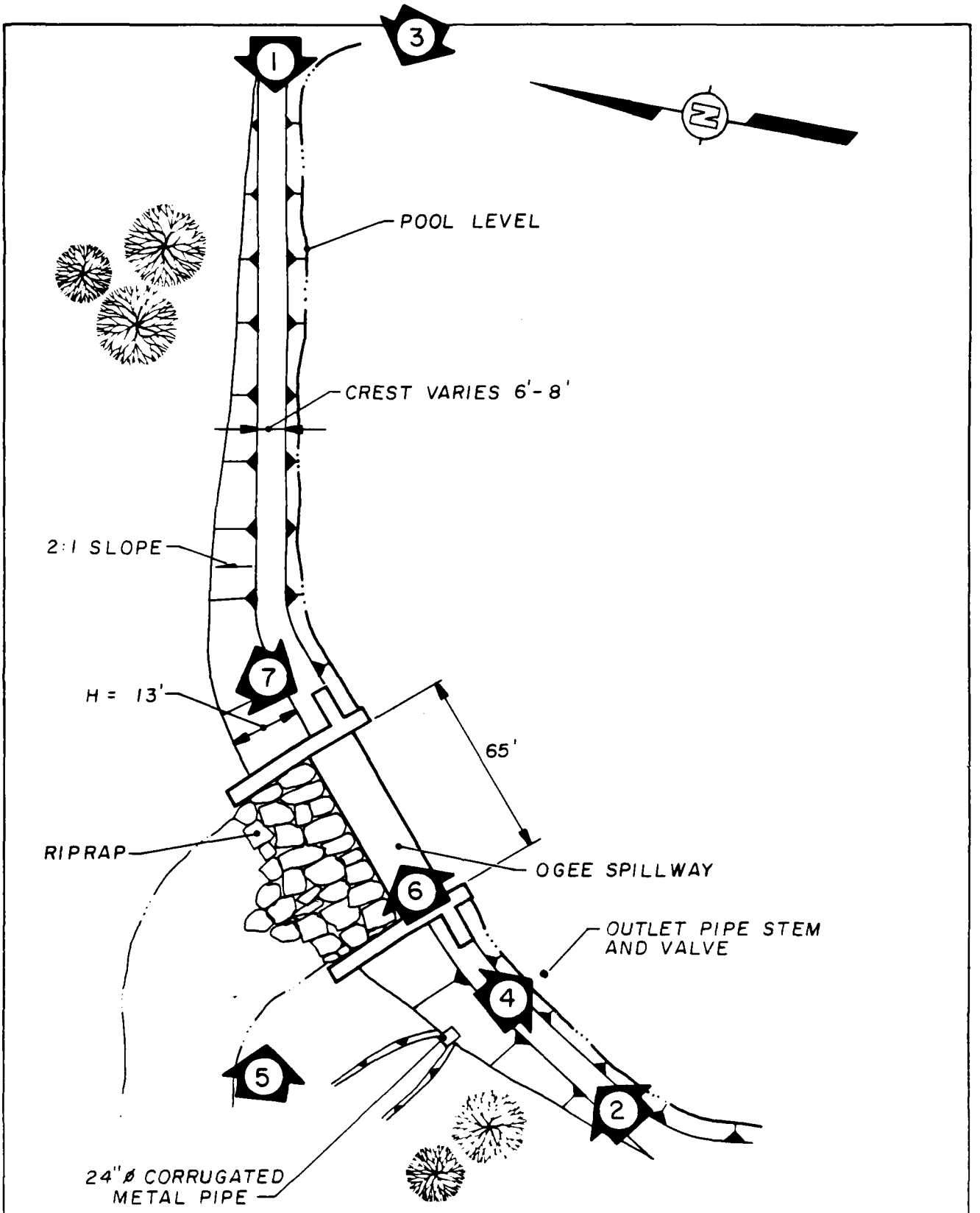
MAXIMUM NONDAMAGING DISCHARGE: Unknown

APPENDIX C

PHOTOGRAPHS

LIST OF PHOTOGRAPHS
MINKLER LAKE DAM
NDI I.D. NO. PA-0052
MARCH 24, 1981

PHOTOGRAPH NO.	DESCRIPTION
1	Dam crest (looking west).
2	Dam crest (looking north).
3	Upstream face.
4	Outlet pipe stem.
5	Ogee spillway (looking upstream).
6	Ogee spillway (right abutment).
7	Right abutment cutoff wall and dam crest low spot.
8	House and trailers along Apalachin Creek (approximately 0.8 mile downstream from dam).



LEGEND:

2 INDICATES DIRECTION IN WHICH PHOTOGRAPH WAS TAKEN.

NOT TO SCALE

MINKLER LAKE DAM
KEY PLAN OF PHOTOGRAPHS
FIELD INSPECTION DATE MAR. 24, 1981

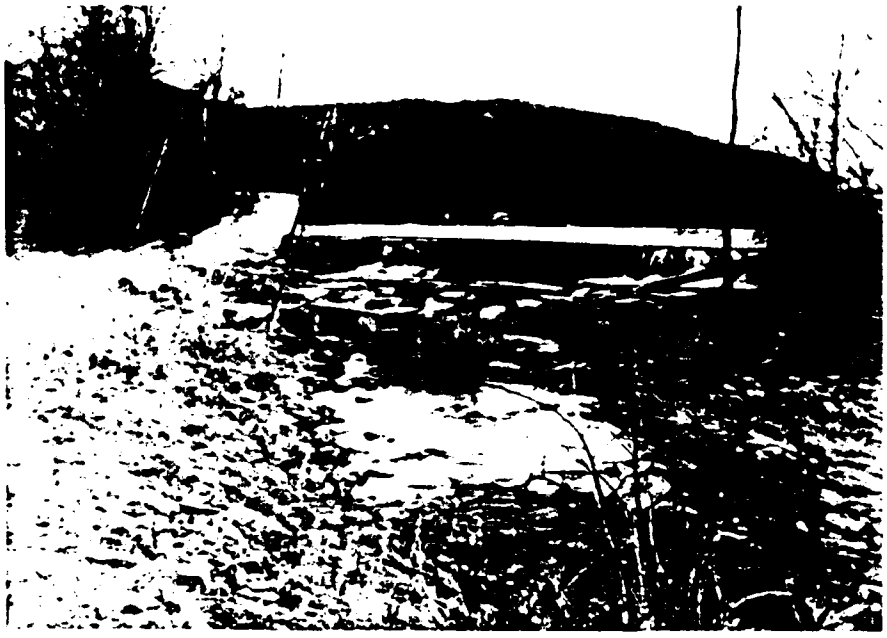
DIAPHOLDNIA

PHOTOGRAPH NO 1

PHOTOGRAPH NO. 2

PHOTOGRAPH NO 3

PHOTOGRAPH NO. 4



PHOTOGRAPH NO 5

PHOTOGRAPH NO 6

PHOTOGRAPH NO 7

PHOTOGRAPH NO 8

APPENDIX D

HYDROLOGY AND HYDRAULICS ANALYSES

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: Minkler Lake Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 INCHES/24 HOURS

STATION	1	2	3	4	5
Station Description	Minkler Lake	Minkler Lake Dam			
Drainage Area (square miles)	3.3	-			
Cumulative Drainage Area (square miles)	3.3	3.3			
Adjustment of PMF for Drainage Area (%)[1]	95%	-			
6 Hours	117	-			
12 Hours	127	-			
24 Hours	136	-			
48 Hours	142	-			
72 Hours	145	-			
Snyder Hydrograph Parameters					
Zone[2]	11A	-			
C_p/C_t[3]	0.62/1.50	-			
L (miles)[4]	3.13	-			
L_{ca} (miles)[4]	1.08	-			
$t_p = C_t(L \cdot L_{ca})^{0.3}$ (hours)	2.16	-			
Spillway Data					
Crest Length (ft)	-	65.0			
Freeboard (ft)	-	4.3			
Discharge Coefficient	-	[illegible]			
Exponent	-	1.5			

(1) Hydrometeorological Report 40, U.S. Weather Bureau, 1965.
(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).
(3) Snyder's Coefficients.
(4) L = Length of longest water course from outlet to basin divide.
L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

STORAGE VS. ELEVATION

ELEVATION	ΔH, FEET	AREA (acres)[1]	ΔVOLUME (acre-feet)[2]	STORAGE (acre-feet)
[illegible]		[illegible]		[illegible]
	[illegible]		[illegible]	
[illegible]		[illegible]		[illegible]
	[illegible]		[illegible]	
[illegible](3)		[illegible]		[illegible]

(1) Planimetered from USGS maps.
(2) $\Delta Volume = \Delta H/3\,(A_1 + A_2 + \sqrt{A_1 A_2})$.
(3) Estimated lake bottom level.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1                 A1       SNYDER UNIT HYDROGRAPH, SPILLWAY AND DAM OVERTOPING ANALYSES
    2                 A2       MINKLER LAKE DAM (DER 58-26), SUSQUEHENNA COUNTY, PA  PROJECT NO 80-556-17
    3                 A3       FOR 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, AND 100% PROBABLE MAXIMUM FLOOD(PMF)
    4                 B     300         0        15         0         0         0         0         0        -4         0
    5                 B1      5
    6                 J       1         9         1
    7                 J1  0 20     0 30     0 40     0 50     0 60     0 70     0 80     0 90    1 00
    8                 K       0         1                                                  1
    9                 K1       CALCULATION OF SNYDER INFLOW HYDROGRAPH TO MINKLER LAKE DAM, (DER 58-26)
   10                 M       1         1     3 30               3 30                                1
   11                 P                21 1      117       127       136       142       145
   12                 T                                                                  1 0       0 5          0 0265
   13                 W    2 16     0 62
   14                 X    -1 5    -0 05      2 0
   15                 K       1         2                                                  1
   16                 K1       ROUTING FLOW THROUGH MINKLER LAKE DAM, (DER 58-26)
   17                 Y                                                  1         1
   18                 Y1      1                                                                -1150 0
   19                 $A   56 0     97 3
   20                 $E1150 0   1160 0
   21                 $$1150 0     65 0      4 0      1 5
   22                 $D1154 3      2 65     1 5    600 0
   23                 $L  145 0    195 0    240 0    350 0    400 0    500 0    600 0
   24                 $V1154 3   1154 6   1154 8   1155 0   1155 3   1155 6   1155 9
   25                 K      99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO APPLIED TO FLOWS								
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				20	30	40	50	60	70	80	90	1.00
HYDROGRAPH AT	1	3.10	1	1409	2114	2819	3523	4228	4933	5637	6342	7047
		(8.55)		(39.91)	(59.86)	(79.82)	(99.77)	(119.72)	(139.68)	(159.63)	(179.59)	(199.54)
ROUTED TO	2	3.30	1	1146	1769	2402	3105	3982	4752	5486	6226	6945
		(8.55)		(32.44)	(49.99)	(68.03)	(90.18)	(112.75)	(134.55)	(155.36)	(176.31)	(196.66)

PLAN 1

SUMMARY OF DAM SAFETY ANALYSIS

ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	1150 00	1150 00	1154 30
	0	0	275
	0	0	2318

RATIO OF PMF	MAXIMUM RESERVOIR W S ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
20	1152 69	0 00	164	1146	0 00	43 00	0 00
30	1153 59	0 00	235	1765	0 00	42 75	0 00
40	1154 39	09	282	2402	1 00	42 75	0 00
50	1154 96	66	324	3185	2 75	42 50	0 00
60	1155 33	1 03	352	3982	3 50	42 25	0 00
70	1155 62	1 32	375	4752	4 25	42 25	0 00
80	1155 86	1 56	393	5486	4 75	42 00	0 00
90	1156 06	1 76	409	6226	5 25	42 00	0 00
1 00	1156 25	1 95	424	6945	5 75	42 00	0 00

FLOOD PEAK DISCHARGE BY REGRESSION EQUATIONS

REFERENCE : HERBERT N. FLIPPO, JR. "FLOODS IN PENNSYLVANIA" WATER RESOURCES BULLETIN NO. 13, U.S. DEPT. OF THE INTERIOR, GEOLOGICAL SURVEY, OCTOBER 1977

FROM PLATE 1 OF REFERENCE, MINKLER LAKE DAM IS LOCATED ON FLOOD - FREQUENCY "2", BASED ON THE RECORDS OF 50 GAGING STATIONS WITH IN THIS REGION, THE FLOOD PEAK DISCHARGES, Q_T, AS SHOWN ON FIG 2 OF REFERENCE, ARE DETERMINED AS FOLLOWS

$$Q_T = C\,A^X \quad ; \quad \text{where } A = \text{WATERSHED AREA} = 3.3 \text{ SQ. MI.}$$

X, C = REGRESSION COEF.

FREQUENCY T-YEAR	REGRESSION COEFFICIENTS			Q_T
	C	X	Standard Error	cfs
10	240	0.782	26% ±	611
25	349	0.765	27% ±	870
50	448	0.754	29% ±	1102
100	564	0.744	31% ±	1371

100 YEAR FLOOD PEAK CALCULATION

REF 1: "HYDROLOGIC STUDY TROPICAL STORM AGNES", ARMY CORPS OF ENGINEERS, DEC., 1975

$$\text{LOG}(P) = \text{LOG}(Q_M) + K(P,G)S$$

WHERE

$\text{LOG}(P)$ = FLOOD PEAK IN CFS FOR A GIVEN EXCEEDENCE FREQUENCY P.

$\text{LOG}(Q_M)$ = MEAN LOG OF ANNUAL FLOOD PEAKS

$$\text{LOG}(Q_M) = C_M + 0.75 \cdot \text{LOG}(A)$$

C_M = A MAP COEFFICIENT (FIG. 21, REF. 1)

A = DRAINAGE AREA IN SQ. MILES

$K(P,G)$ = STANDARD DEVIATE FOR A GIVEN P AND SKEW COEFFICIENT G.

S = STANDARD DEVIATION

$$S = C_S - 0.05 \text{LOG}(A)$$

C_S = A MAP COEFFICIENT (FIG. 22, REF. 1)

G = SKEW COEFFICIENT (FIG. 23, REF. 1)

D'APPOLONIA
CONSULTING ENGINEERS, INC

By MB Date 4/20/81 Subject MINKLER LAKE DAM Sheet No. 2 of 2
Chkd. By WTC Date 4/29/81 100 YR FLOOD PEAK Proj. No. 80-556

MINKLER LAKE DAM 100 YEAR FLOOD P = 0.01

DRAINAGE AREA = 3.3 SQ MILES
C_M = 2.18
C_S = 0.37
G = 0.26

$$\text{LOG } Q_M = 2.18 + 0.75 \text{ LOG}(3.3) = 2.57$$

$$S = 0.37 - 0.05 \text{ LOG}(3.3) = 0.34$$

FROM REF. 1, EXHIBIT 39
$K(P, G) = K(0.01, 0.26) = 2.515$

$$\text{LOG } Q_{0.01} = 2.57 + 2.515(0.34)$$
$$= 3.43$$

$$Q_{100YR} = 10^{3.43} = 2690 \text{ CFS}$$

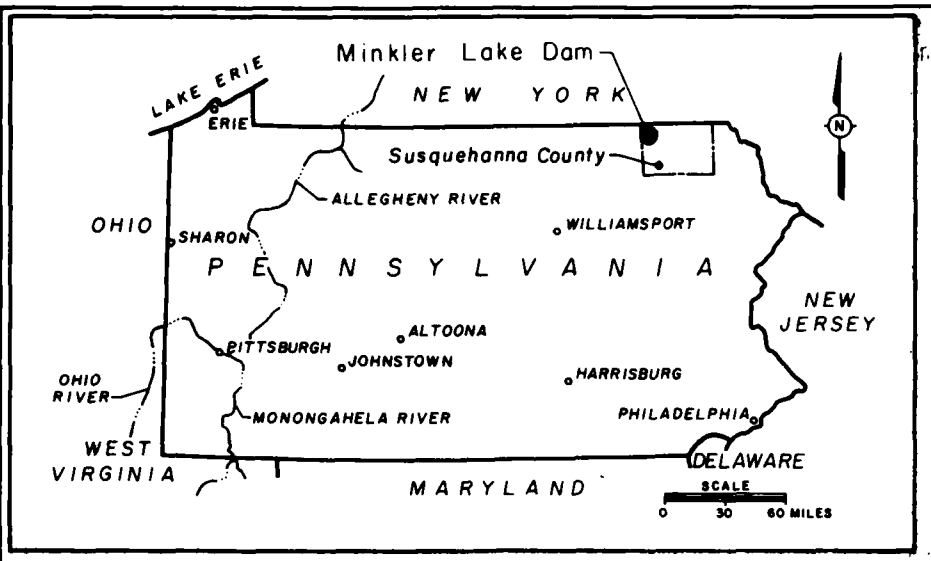
PER CORPS OF ENGINEER MEMO, DATED 4/22/81, THE ADOPTED 100 YEAR FLOOD PEAK IS THE AVERAGE OF METHODS A AND B

$$Q_{100} = \frac{2690 + 1371}{2}$$
$$= 2030 \text{ CFS}$$

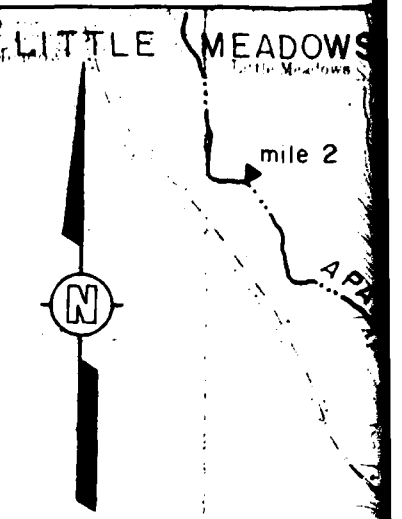
APPENDIX E

PLATES

DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
ACS	RE	[illegible]	80-556-B23
12-22-80	[illegible]	[illegible]	



KEY PLAN



MINKLER LAKE DAM

REFERENCES:

1. U.S.G.S. FRIENDSVILLE, PA.-NY QUADRANGLE PHOTOREVISED 1978, SCALE 1:24000
2. U.S.G.S. LITTLE MEADOWS, PA-NY QUADRANGLE PHOTOREVISED 1978, SCALE 1:24000

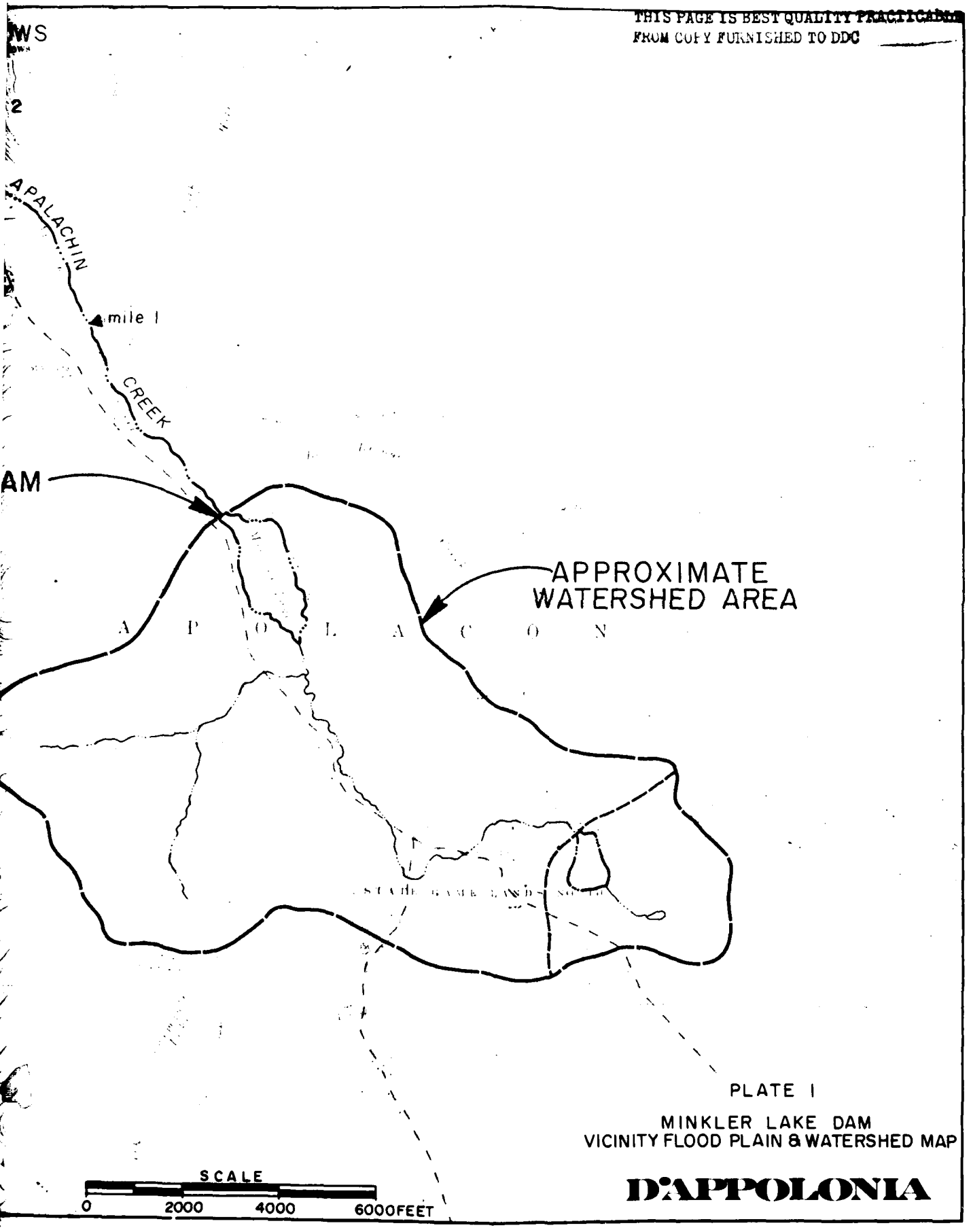
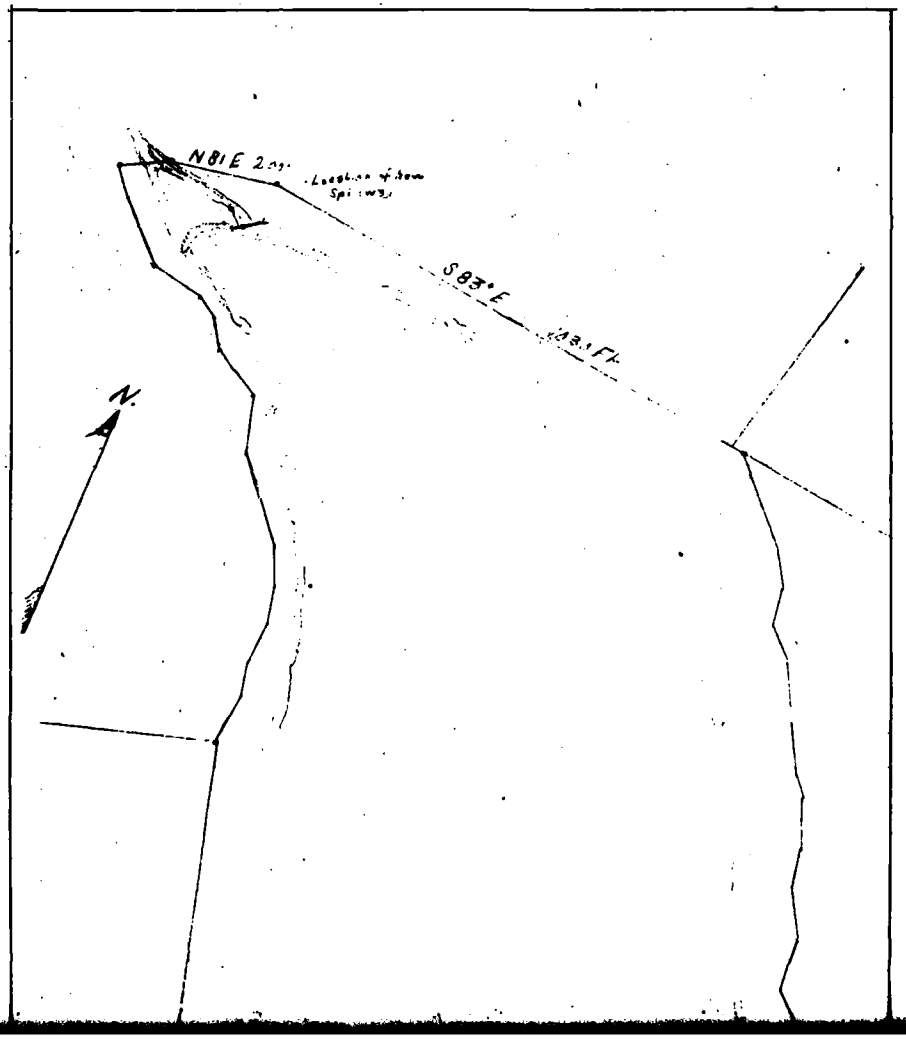


PLATE 1

MINKLER LAKE DAM
VICINITY FLOOD PLAIN & WATERSHED MAP

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY	RE	4/29/81	DRAWING NUMBER 80-556-B24
	4-28-81	APPROVED BY	JHD	4-29-81	



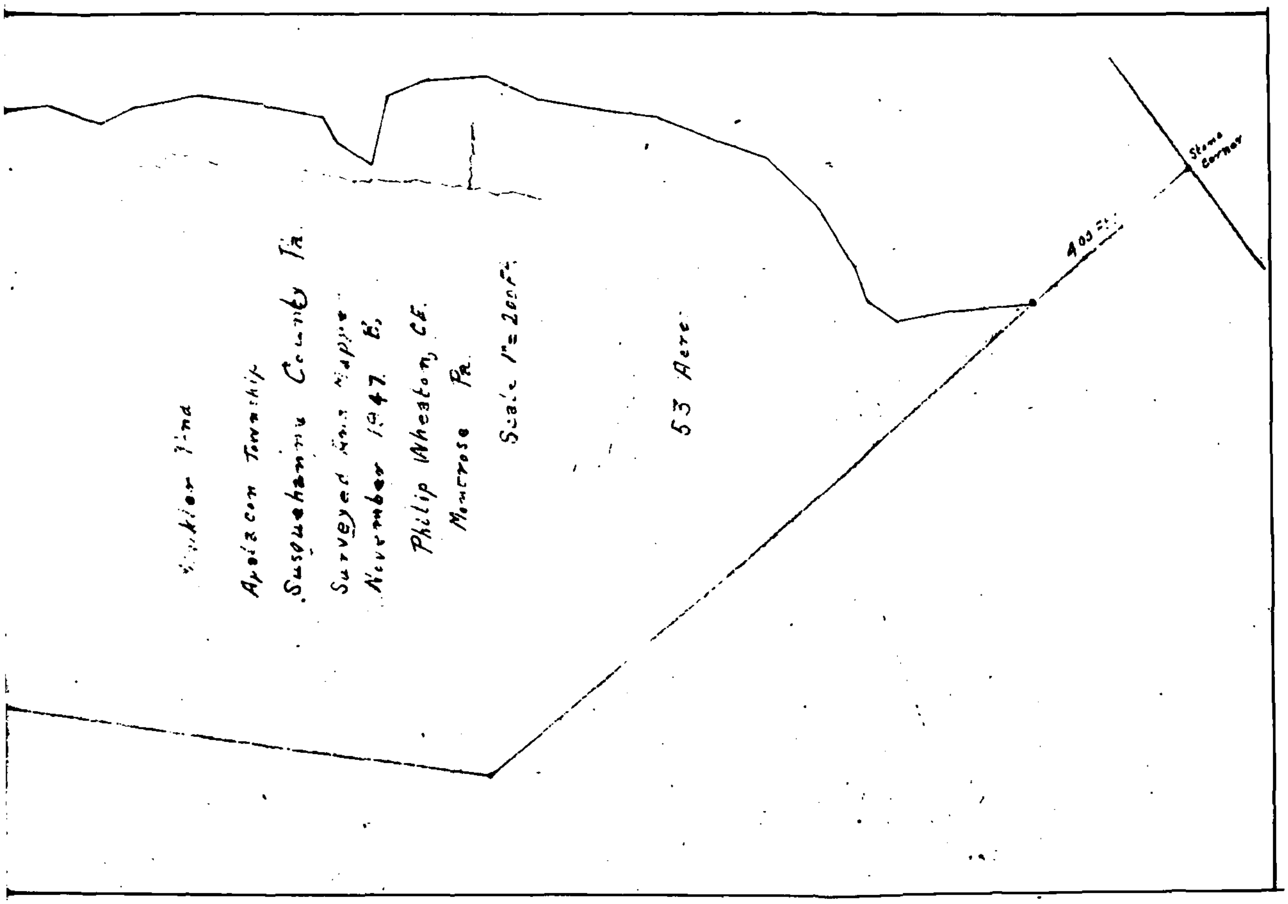
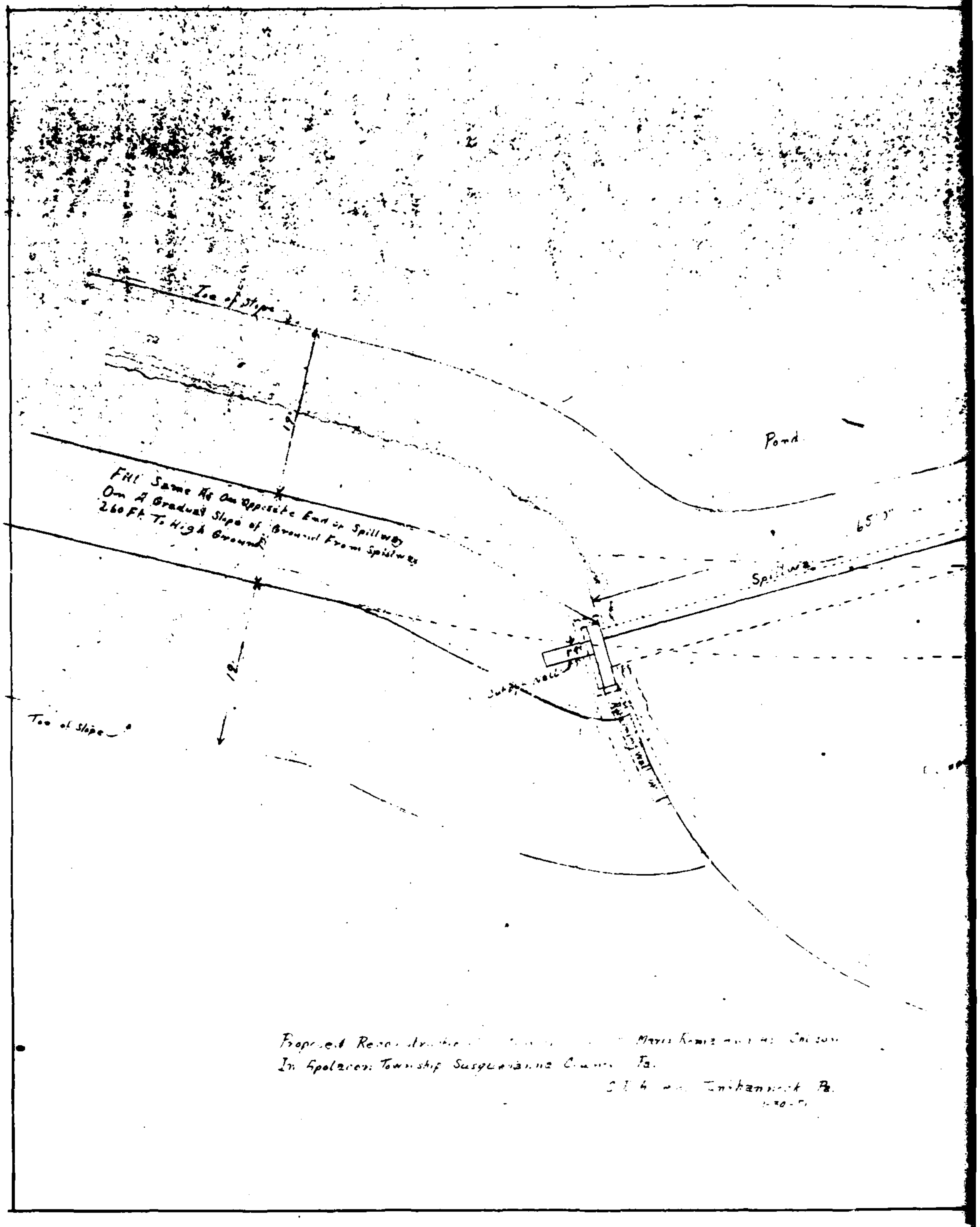


PLATE 2

D'APPOLONIA



DRAWN BY	ACS	4-28-81
CHECKED BY		4/28/81
APPROVED BY		4-28-81
DRAWING NUMBER	80-556-B25	

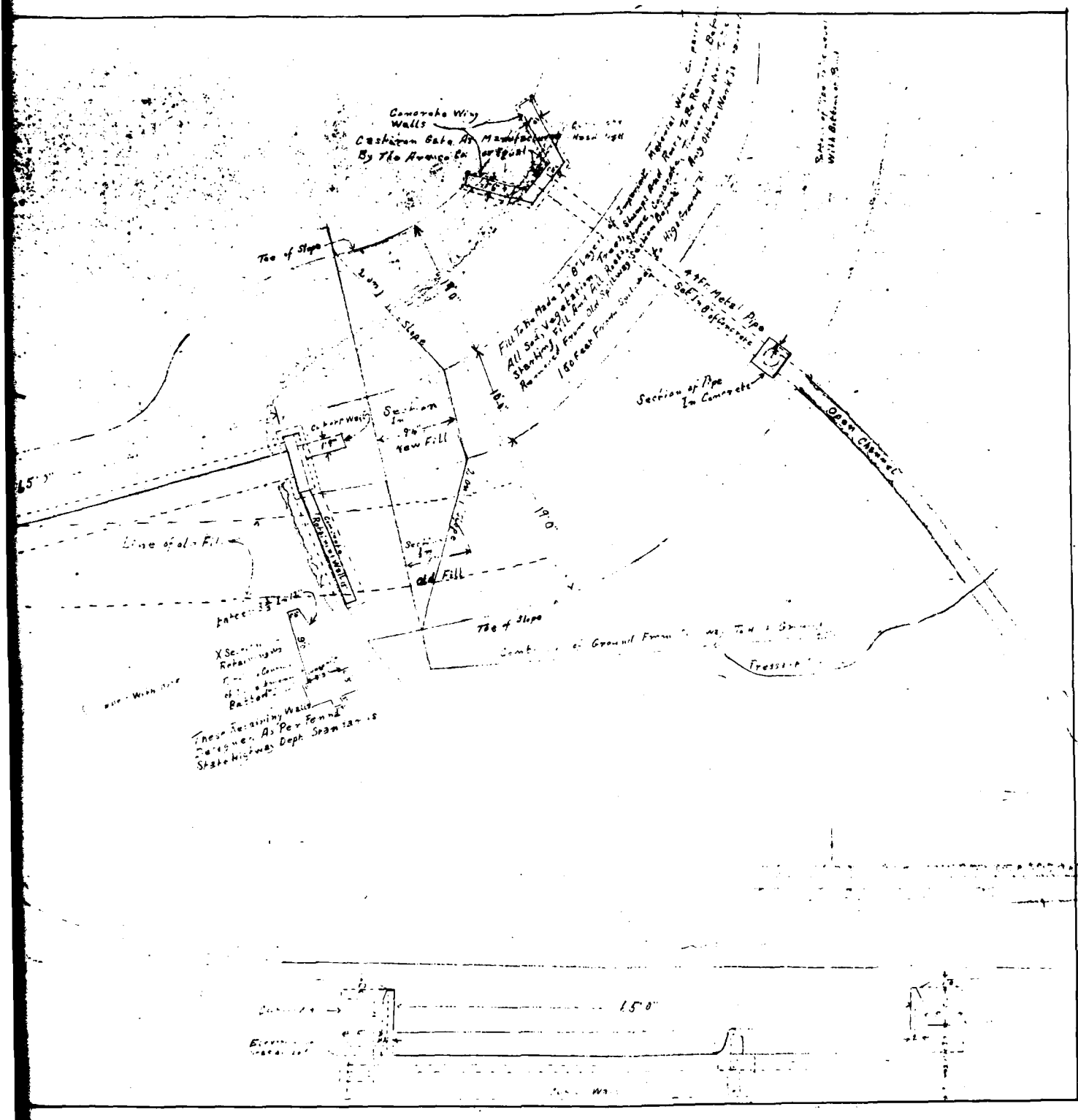


PLATE 3

D'APPOLONIA

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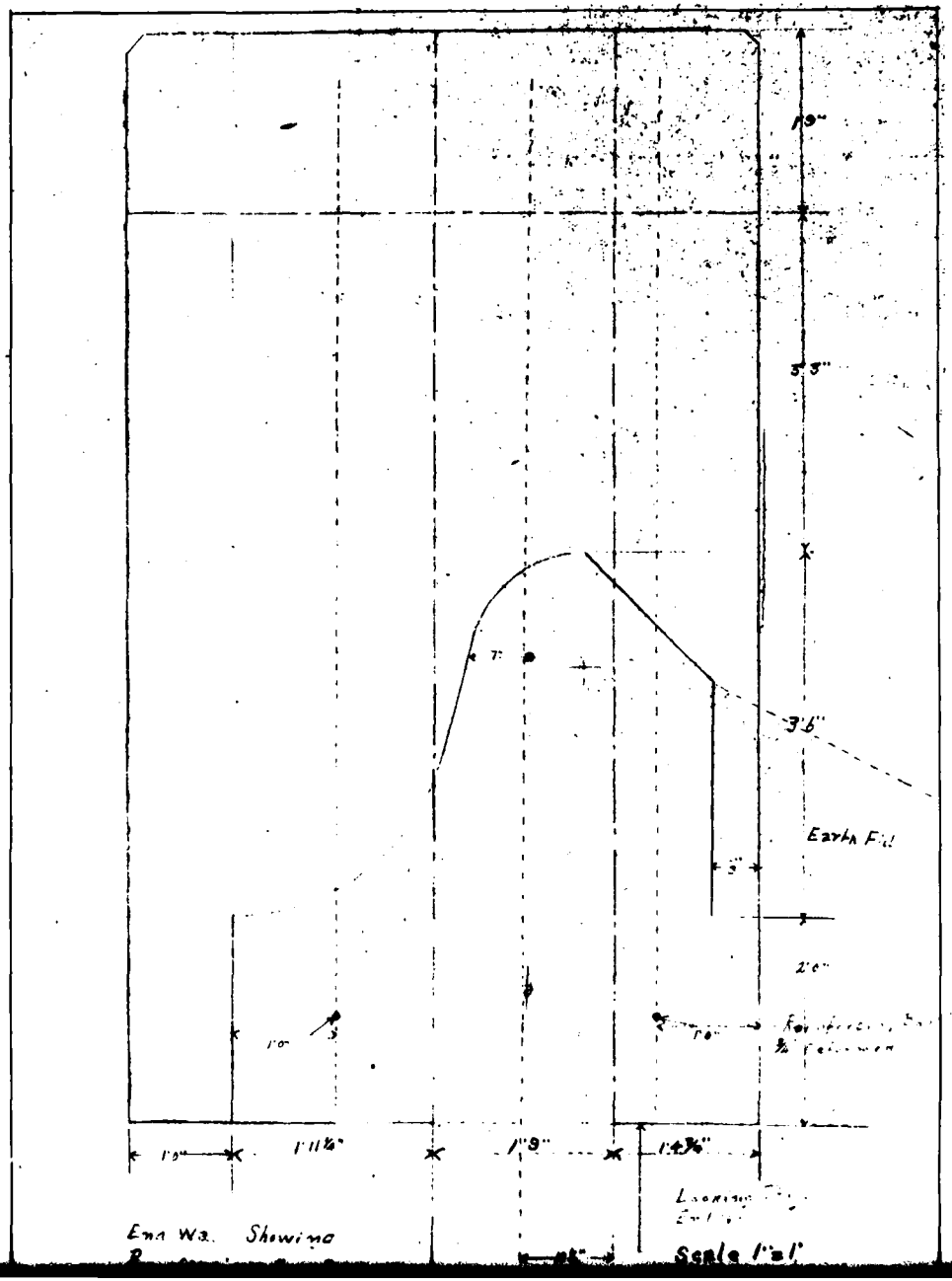


End Wall Showing

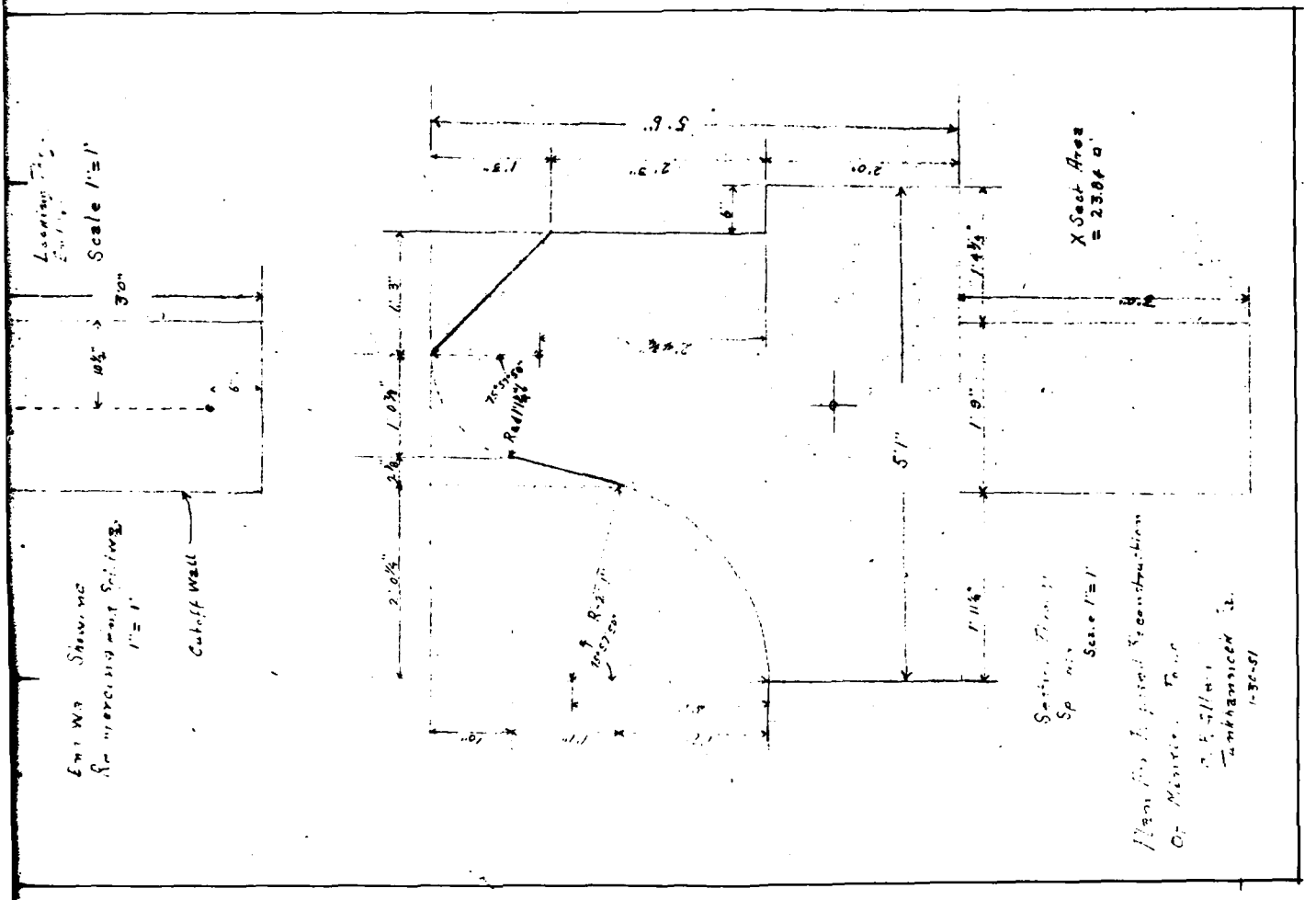


PLATE 4

DRAWN BY	ACS	CHECKED BY		DRAWING NUMBER 80-556-A29
	4-28-81	APPROVED BY	4/29/81 2.24.81	

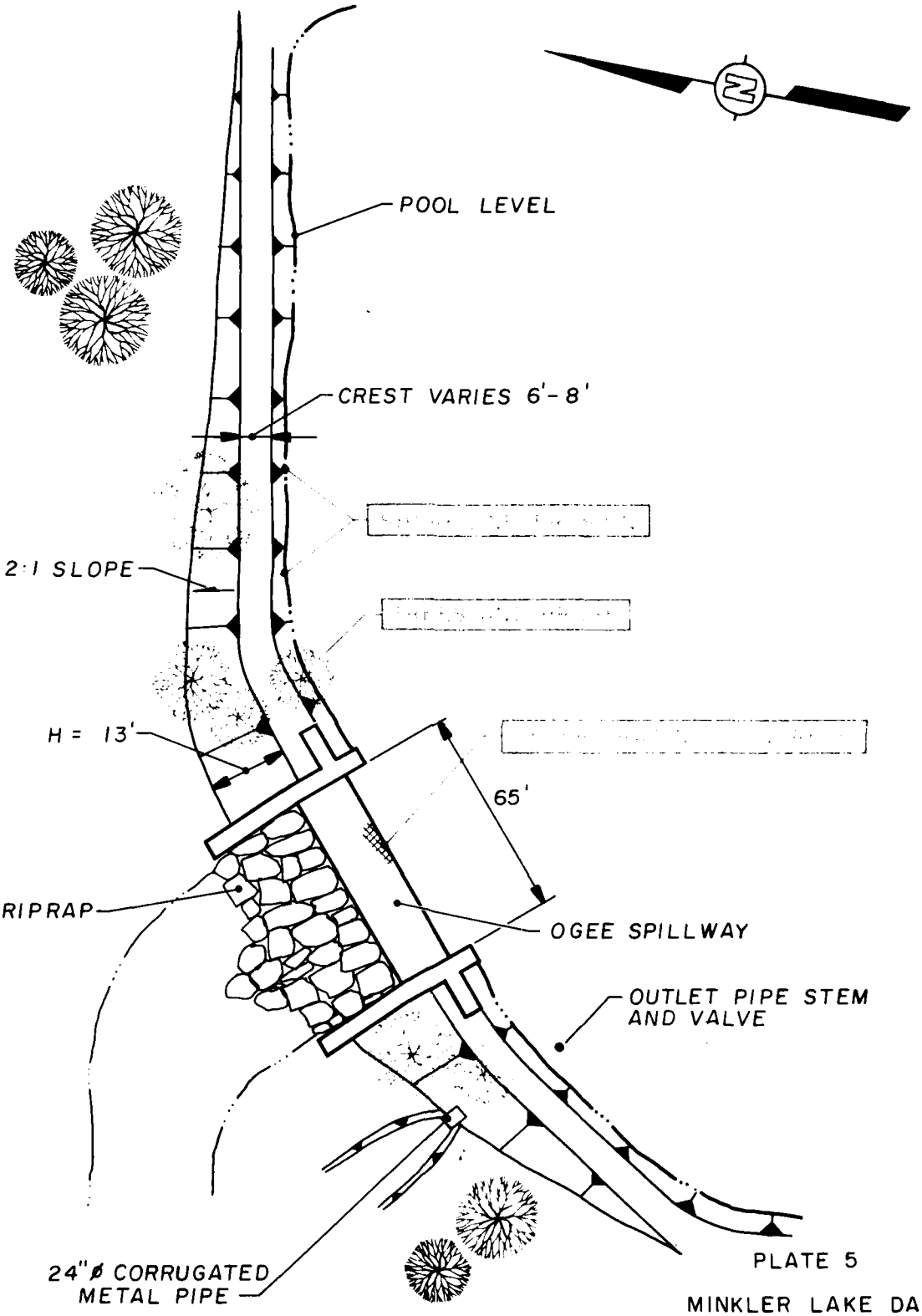


PLATE 5

MINKLER LAKE DAM
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE: MAR. 24, 1981

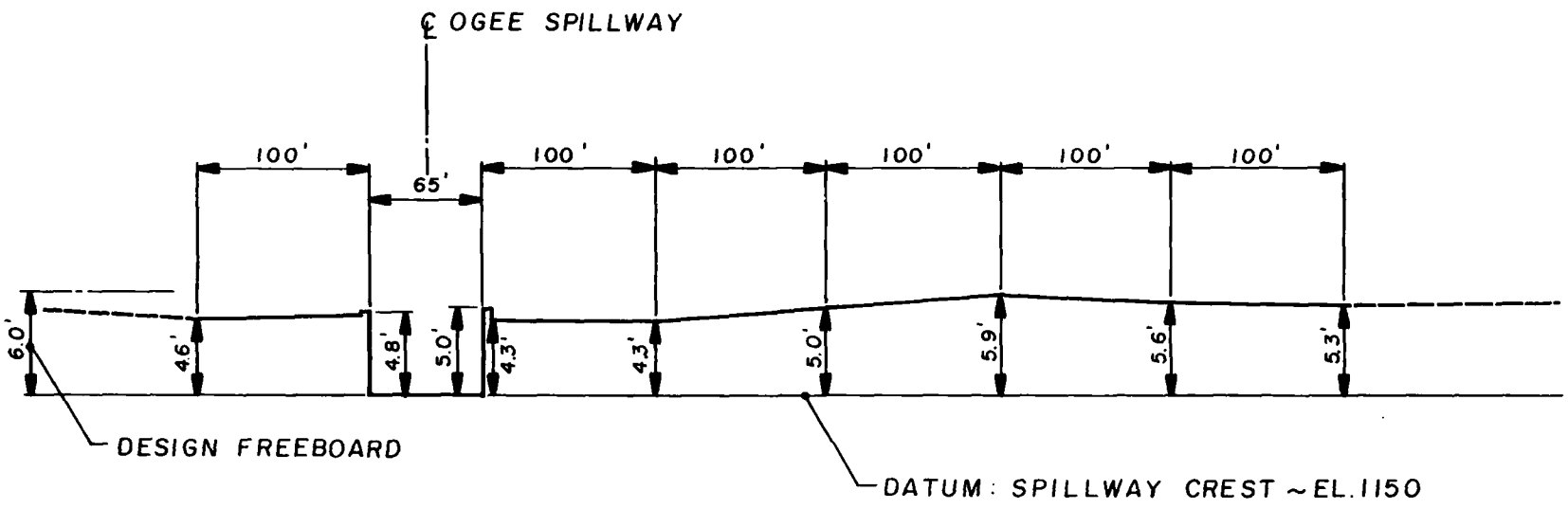
NOTE:

POOL LEVEL AT DATE OF INSPECTION: AT SPILLWAY CREST.

NOT TO SCALE

DAPPOLONIA

DRAWN BY	ACS 4-1-81	CHECKED BY / APPROVED BY	BE / JHP	4/29/81 / 4-29-81	DRAWING NUMBER 80-556-A30



DAM CREST PROFILE

(LOOKING DOWNSTREAM)

NOTES:

1. DAM CREST WAS SURVEYED RELATIVE TO SPILLWAY CREST LEVEL.
2. DATUM ELEVATION WAS INTERPOLATED FROM USGS MAP, THEREFORE IS APPROXIMATE

PLATE 6

MINKLER LAKE DAM
DAM CREST SURVEY
FIELD INSPECTION DATE: MAR. 24, 1981

DAPPOLONIA

APPENDIX F

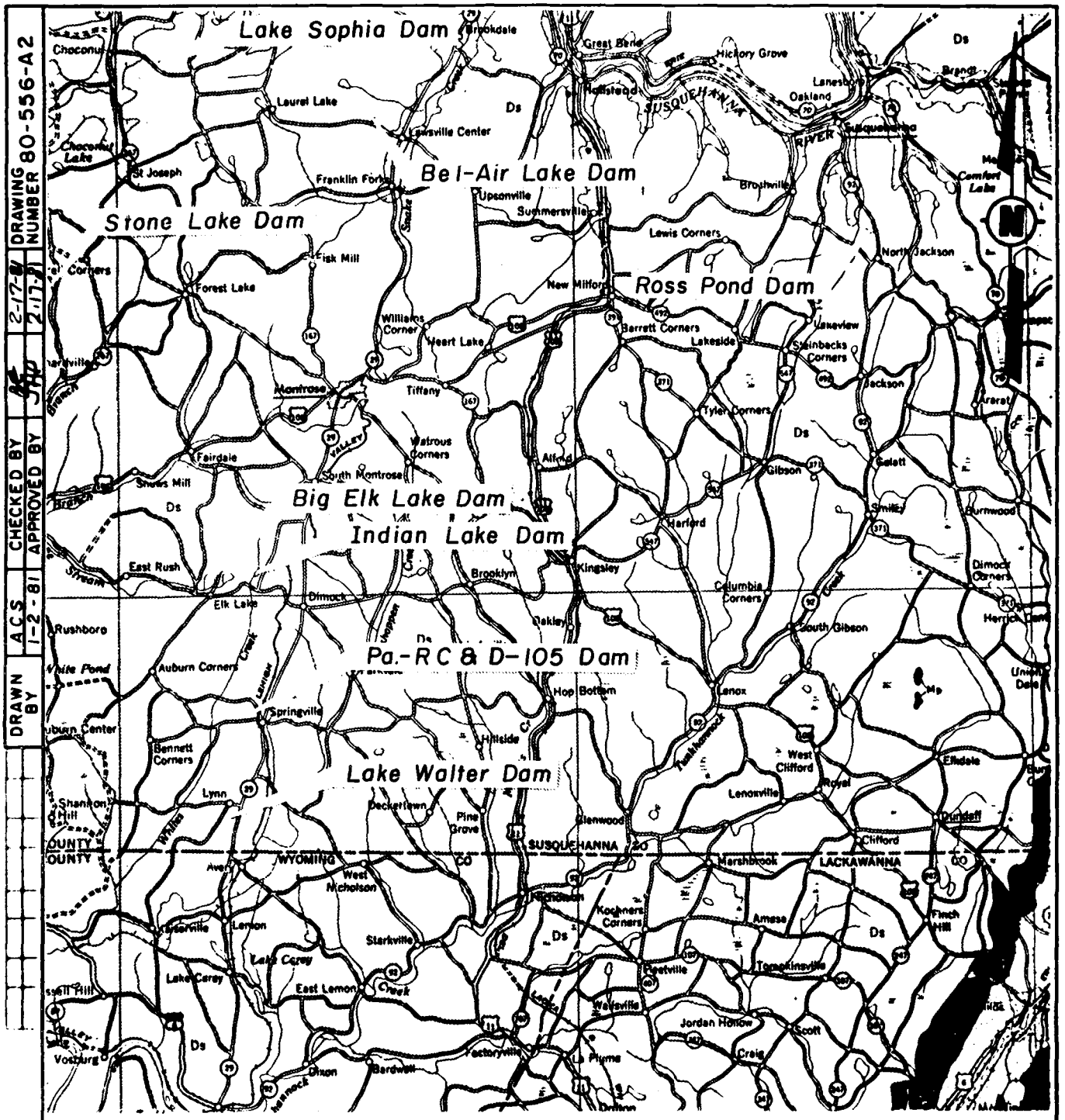
REGIONAL GEOLOGY

REGIONAL GEOLOGY
MINKLER LAKE DAM

The Minkler Lake Dam is located in the glaciated low plateaus section of the Appalachian Plateau physiographic province, characterized as a mature glaciated plateau of moderate relief.

The geologic structure consists of a series of northeast trending folds (approximately N70°E) which plunge gently to the southwest. The dip of the limbs of the folds in the vicinity of the Minkler Lake Dam is less than two degrees, with the southeast limb slightly steeper than the northwest limb. The dam is located south of the Windham Syncline. In general, the discontinuity trends are northeast and northwest.

The stratigraphy consists of glacial till which will range in thickness from very thin to approximately 200 feet. The glacial till is underlain by the Devonian Chemung Formation, which is approximately 380 feet thick in this area. The Chemung Formation is marine in origin, consisting of interbedded green-gray sandstone, sandy shale and shale. The shale strata tend to weather rapidly when exposed.



GEOLOGY MAP

REFERENCE

GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA, DEPARTMENT OF ENVIRONMENTAL RESOURCES, DATED: 1960
SCALE 1:250,000

D'APPOLONIA

DRAWING NUMBER 80-556-A2
2-17-81
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APPROVED BY
A.C.S 1-2-81
DRAWN BY

DRAWN BY	ACS	CHECKED BY		DRAWING NUMBER 80-556-A4
	1-2-81	APPROVED BY	2-17-81	

PENNSYLVANIAN

APPALACHIAN PLATEAU

Allegheny Group
Cyclic sequences of sandstone, shale, limestone and coal, numerous commercial coals, limestones thicken westward; Vanport Limestone in lower part of section, includes Freeport, Kittanning, and Clarion Formations.

Pottsville Group
Predominantly sandstones and conglomerates with thin shales and coals; some coals mineable locally.

ANTHRACITE REGION

Post-Pottsville Formations
Brown or gray sandstones and shales with some conglomerate and numerous mineable coals.

Pottsville Group
Light gray to white, coarse grained sandstones and conglomerates with some mineable coal; includes Sharp Mountain, Schuylkill, and Tumbling Run Formations.

MISSISSIPPIAN

Mauch Chunk Formation
Red shales with brown to greenish gray flaggy sandstones, includes Greenbrier Limestone in Fayette, Westmoreland, and Somerset counties, Loyalhanna Limestone at the base in southwestern Pennsylvania.

Pocono Group
Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale, includes in the Appalachian Plateau Burgoon, Shenango, Cuyahoga, Cussewago, Corry, and Knapp Formations, includes part of "Oneayo" of M. L. Fuller in Potter and Tioga counties.

DEVONIAN

UPPER

CENTRAL AND EASTERN PENNSYLVANIA

Oswayo Formation
Brownish and greenish gray, fine and medium grained sandstones with some shales and scattered calcareous lenses; includes red shales which become more numerous eastward. Relation to type Oswayo not proved.

Dck

Catskill Formation
Chiefly red to brownish shales and sandstones; includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.

Dm

Marine beds
Gray to olive brown shales, graywackes, and sandstones; contains "Chemung" beds and "Portage" beds including Burket, Brallier, Harrell, and Trimmers Rock; Tully Limestone at base.

Ds

Susquehanna Group

Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey County reports; barbs on "Chemung" side of line.

GEOLOGY MAP LEGEND

REFERENCE:

GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA., DEPARTMENT OF ENVIRONMENTAL RESOURCES, DATED: 1960
SCALE 1 : 250,000

D'APPOLONIA

19 1293 HERCULENE. A&B SMITH CO., PGH., PA LT1530-1079